Factors Influencing Infant Mortality in Indonesia in 1991

**Kasmiyati, Leli Asih,
Emiliana Tjitra and Hadriah Oesman**

Abstract. *Indonesia's infant mortality rate declined to 64 infant deaths per 1,000 live births in 1991. Adolescent mothers, women who first married under the age of 18, and mothers who did not obtain antenatal care and tetanus immunizations were at greater risk of experiencing an infant death. In addition, levels of infant mortality were substantially higher when births were spaced closer together. For example, the infant mortality rate among adolescent mothers was 125 when births were spaced less than 24 months apart and 96 when births were separated by more than two years. Roughly half of all infant deaths occur within the first 28 days of life in Indonesia. Findings indicate that mothers who were less than 20 years of age, who did not have antenatal care and tetanus immunizations, and who spaced births less than 24 months apart were more likely to experience a neonatal death. With the exception of antenatal care, these factors were also associated with elevated levels of postneonatal mortality (infant deaths that occur when infants are between 1-12 months of age). However, postneonatal mortality was also higher among mothers who gave birth at home rather than in a health facility, who were assisted at delivery by non-medical staff, and who had lower levels of educational attainment. Postneonatal mortality is determined by a broader array of program and socioeconomic measures than neonatal mortality, and may be reduced more readily through Family Planning/Mother and Child Health (FP/MCH) service interventions. In order to reduce both neonatal and postneonatal mortality, greater effort should be made to increase the age at first birth, space births more than two years, and attain higher tetanus coverage levels among expectant mothers.*

Keywords: Infant mortality rate; neonatal mortality; birthspacing; maternal age; Indonesia.

1. Introduction

The study of infant mortality and strategy to control it is one of the *Panca Karsa Husada* (Five Major Objectives) which are the main health

policies of the Indonesian government. In order to know the levels of infant mortality in Indonesia, this paper discusses infant, neonatal and postneonatal mortality. Thus, this paper aims to estimate the infant, neonatal and postneonatal mortality rates in Indonesia and the factors influencing these rates.

Data used in the analysis comes from the 1991 Indonesia Demographic and Health Survey (IDHS). The unit of analysis is mothers who had live births in 1986-1990. Twin births are excluded. The dependent variable is the infant, neonatal and postneonatal mortality rate. The independent variables are divided into three broad categories which are:

a. Socioeconomic, cultural and environmental factors, which include mother's educational attainment (Primary School/SD or lower, Junior High School/SLTP, and Senior High School/SLTA or higher), mother's age at first married (less than 18, and 18 or more), drinking water facility (pipe or pump, and others such as well, spring, river and rain water), and sanitation facility (private septic tank, shared public septic tank, and others such as river, bush and forest);

b. Biological factors which include the mother's age at childbirth (less than 20, 20-34, and 35 or more) and birth interval (less than 24 months, and 24 months or more);

c. Health services factors which include whether the mother had antenatal care during pregnancy (yes, no), place of delivery (health facilities, at home), whether the mother had tetanus immunization during pregnancy (yes, no) and delivery assistant (medical staff, non-medical staff).

The main results presented here are based on the selection of variables which have significant association with infant mortality. Results which are not very significant are also analyzed but the figures are not displayed.

The analysis employs bivariate and multivariate analysis (linear regression model).

2. Results

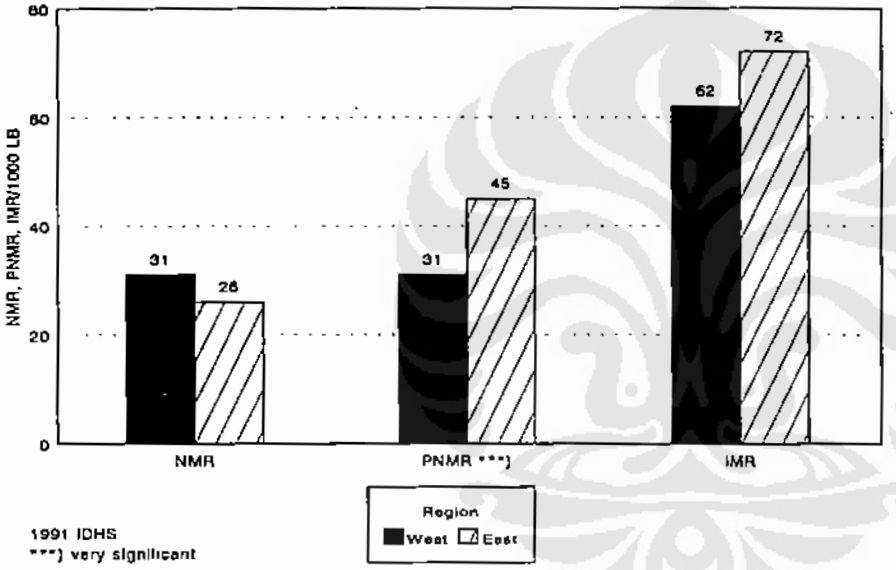
The results indicate that, the infant mortality rate (IMR) in Indonesia in 1991 reached 64 infant deaths per 1000 live births while the neonatal mortality rate (NMR) and postneonatal mortality rate (PNMR) was 31 and 33 infant deaths per 1000 live births respectively. These figures are different from the figures reported in the 1991 IDHS report because the unit of analysis is different. The 1991 IDHS reported that the IMR was 67.8, NMR was 31.7 and PNMR was 36.1. As mentioned before, twin births are excluded in this analysis. In addition,

the estimation of infant mortality here used births which occurred one year before the survey. The 1991 IDHS also used the life-table method in the estimation of the mortality rate while this analysis used direct estimation by dividing the number of births by the number of infant deaths in a certain period.

2.1 Infant, neonatal and postneonatal mortality rate by region

In this analysis Indonesia is divided into two regions: West (Western Indonesia) and East (Eastern Indonesia). The differential of infant mortality rate by region is displayed in Figure 1.

Figure 1
NEONATAL, POSTNEONATAL AND INFANT MORTALITY RATE BY REGION



As can be seen from the figure, the IMR and PNMR is higher in Eastern Indonesia than in Western Indonesia. The difference is 10 and 14 infant deaths per 1000 live births respectively. The NMR shows a different pattern: it is five infant deaths per 1000 live births higher in Western Indonesia than in Eastern Indonesia. This difference might be attributed to the high infant mortality rate in West Java (111 infant deaths per 1000 live births) so that the NMR in Western Indonesia is higher than in Eastern Indonesia. It also may be caused by memory lapse of respondents in Eastern Indonesia in reporting neonatal deaths in the past. They might report the infant deaths that occurred in a year before the survey as infant deaths that occurred more than a year before the survey. However, the results indicate that region does not have a significant effect on neonatal mortality.

2.2 Neonatal mortality rate by area (urban/rural) and the presence of antenatal care

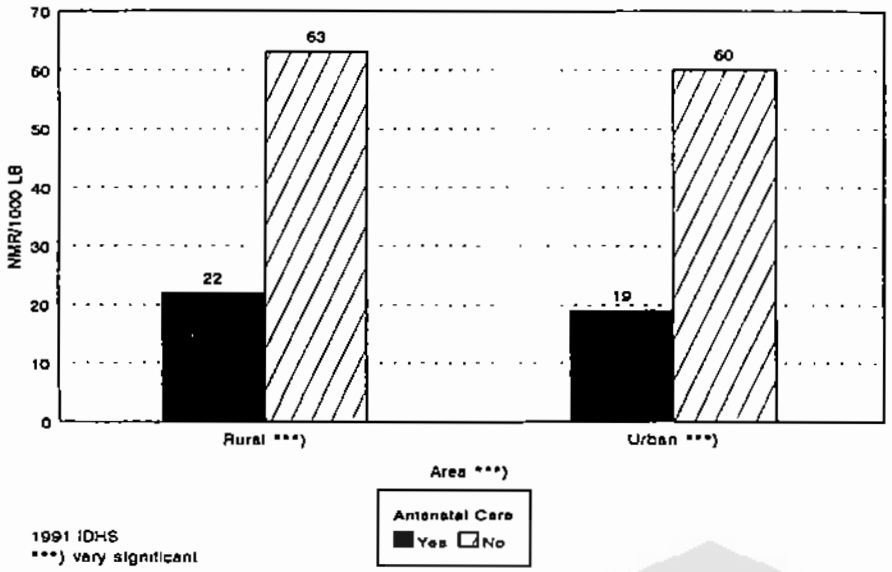
In general, the results show that the proportion of mothers who had antenatal care is 79.0 percent and those who did not have antenatal care is 21.0 percent. By region, 18 percent and 40 percent of mothers in Western and Eastern Indonesia respectively did not have antenatal care. By area of residence (urban/rural), the proportion of mothers who had antenatal care during their pregnancies is 73.2 percent in rural areas and 93.6 percent in urban areas. Figure 2 shows that in general the neonatal mortality rate in urban and rural areas is slightly different.

After controlling for area of residence, the effect of the presence of antenatal care on neonatal mortality rate is still present: mothers who had antenatal care during their pregnancies have lower neonatal mortality rate than mothers who did not have antenatal care during their pregnancies.

The presence of antenatal care has a negative significant impact on neonatal mortality, that is, the neonatal mortality rate is lower for those who had antenatal care during their pregnancies than the neonatal mortality rate for those who did not have antenatal care during their pregnancies. This is reasonable since if there is a deficiency in the fetus it can be detected and prevented as soon as possible if the mothers check their pregnancies.

After controlling for all other variables, it is found that the presence of antenatal care has an impact on neonatal mortality. Mothers who did not have antenatal care during their pregnancies have a mortality rate two times higher than mothers who had antenatal care during their pregnancies.

Figure 2
NEONATAL MORTALITY RATE BY AREA AND ANTENATAL CARE



2.3 Infant, neonatal and postneonatal mortality rate by mother's educational attainment and mother's age when first married

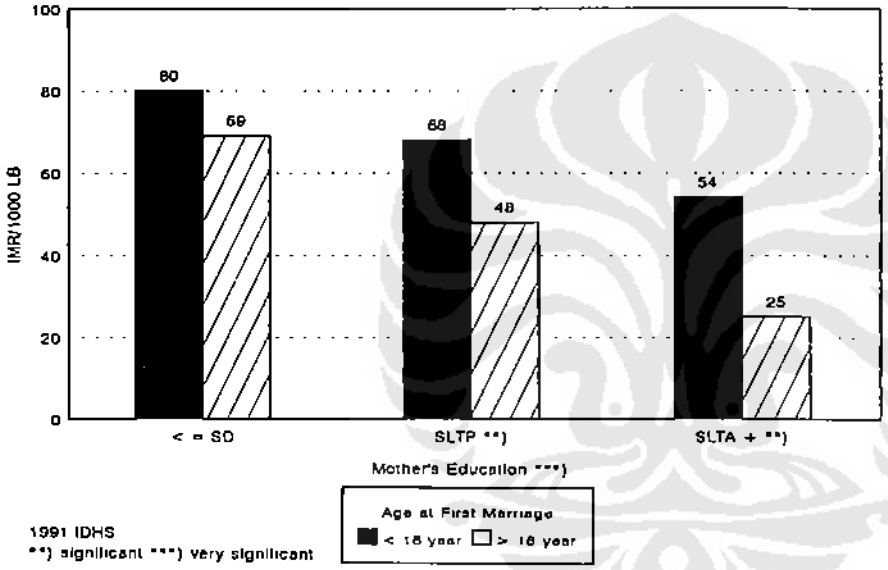
The results show that the higher the mother's educational attainment, the lower the infant mortality rate. The rate for those who had primary education or lower is even higher than national rate. Meanwhile, the rate for those who had junior high school education is about 48 to 68 infant deaths per 1000 live births. Those who had senior high school education have the lowest infant mortality rate.

Age at time of first marriage has negative association with infant mortality rate. This relationship remains even after controlling for educational attainment. Figure 3 shows that those who were first married at 18 or more have lower infant mortality rate than those who were first married before 18. This pattern is also held for all educational attainment. Thus, both educational attainment and age when first married together have influence on infant mortality.

The same pattern can be seen in the neonatal and postneonatal mortality rate: the higher the educational attainment, the lower the neonatal and postneonatal mortality rate. For all educational attainment, the neonatal and postneonatal mortality rate is lower for those who were first married at 18 or more than for those were first married before 18.

The results of multivariate analysis indicate that educational attainment has a very significant effect on postneonatal mortality. Those who had primary school or junior high school education have a postneonatal mortality rate 1.5 times higher than those who had senior high school education. Although the results of bivariate analysis indicate that the infant mortality rate has a significant relationship with educational attaintment the results of multivariate analysis do not indicate so.

Figure 3
INFANT MORTALITY RATE BY EDUCATION AND AGE WHEN FIRST MARRIED

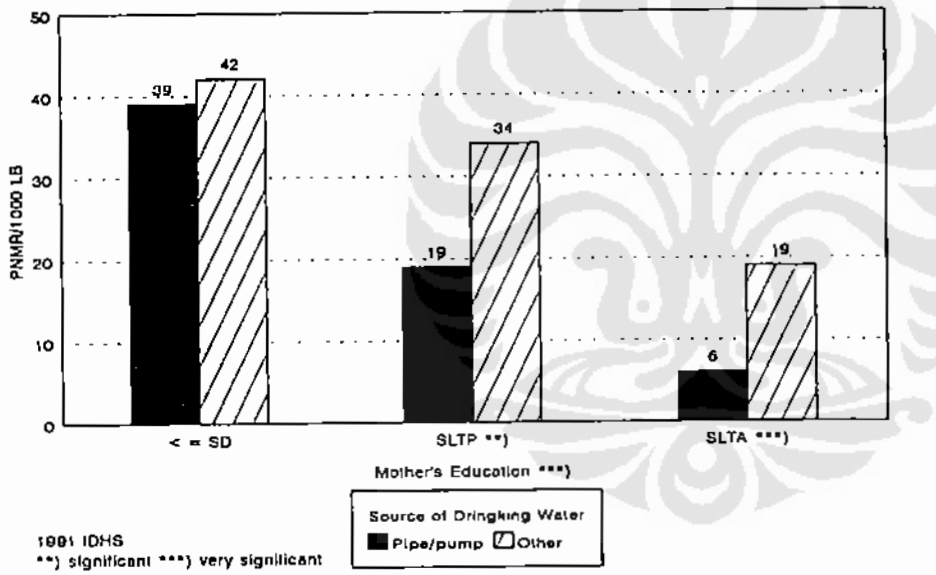


2.4 Postneonatal mortality rate by mother's educational attainment and source of drinking water

The source of drinking water is one of the factors which determine the level of family health. Theoretically the level of family health influences the level of postneonatal mortality. The results show that mother's educational attainment also has the same negative effect on postneonatal mortality as on infant mortality. The higher the mother's education, the lower the postneonatal mortality rate.

Figure 4 shows that for those who had SLTP (Junior High School) education, the postneonatal mortality rate is almost two times higher for those who used other sources as the source of drinking water than for those who used pipe or pump. For those who had SLTA (senior High School) education the rate is three times higher. Meanwhile for those who had SD (Elementary School) or lower education the rate differs slightly which might be due to the lack of knowledge in using clean and healthy drinking water.

Figure 4
POSTNEONATAL MORTALITY RATE BY EDUCATION AND SOURCE OF DRINKING WATER



The source of drinking water has a very significant relationship to the postneonatal mortality rate for those who had SLTP education or higher. After controlling for all variables, this factor has less effect on the postneonatal mortality rate. It might be caused by education which has a significant effect on postneonatal mortality.

2.5 Neonatal, postneonatal and infant mortality rate by mother's age at childbirth and delivery assistance

Figure 5 shows that the neonatal mortality rate is more than two times higher for mothers who were younger than 20 years at childbirth than for mother's who were 20-34 years or 35 years or older at childbirth. The mortality pattern according to a mother's age at childbirth follows a U-shape, that is, it is higher for mothers who were younger than 20 years or who were 35 years or older than for mother's who were 20-34 years at childbirth. It is as expected since the safest age for childbearing is 20-34 years so these women have the lowest neonatal mortality rate.

Figure 5
NEONATAL MORTALITY RATE BY AGE AT CHILDBIRTH AND DELIVERY ASSISTANCE

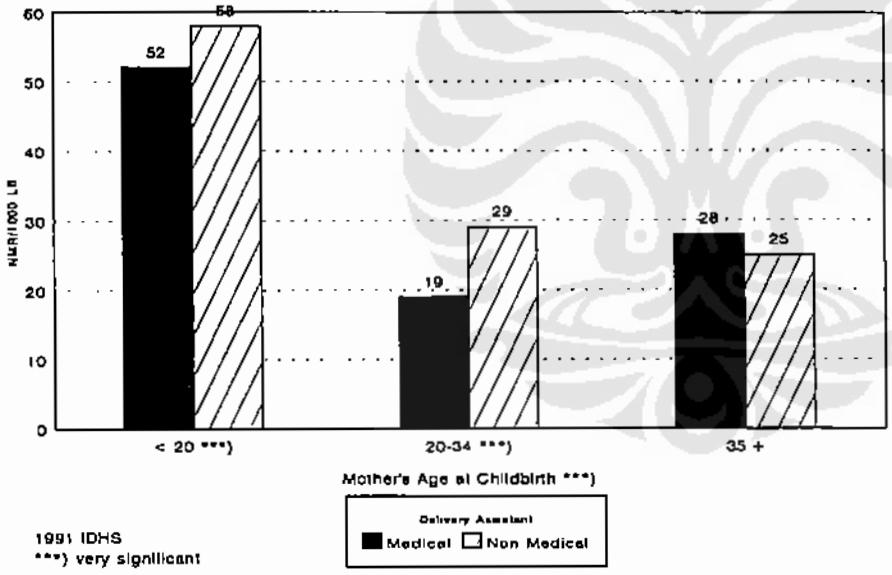


Figure 5 also shows that by delivery assistance those who were helped by medical staff have lower neonatal mortality rate than those who were helped by non-medical staff, except for those who were 35 years or older at childbirth. The rate is different slightly between the two groups of mothers.

The neonatal mortality pattern is the same with the infant mortality pattern by mother's age at childbirth and delivery assistance. The IMR is highest for mothers who were younger than 20 years at childbirth (more than 70 infant deaths per 1000 live births). The pattern is consistent even after controlling for mother's age at childbirth. Those who were helped by medical staff have lower infant mortality rate than those who were helped by non-medical staff at labor for all age groups at childbirth. This indicates that medical staff are needed in helping delivery process.

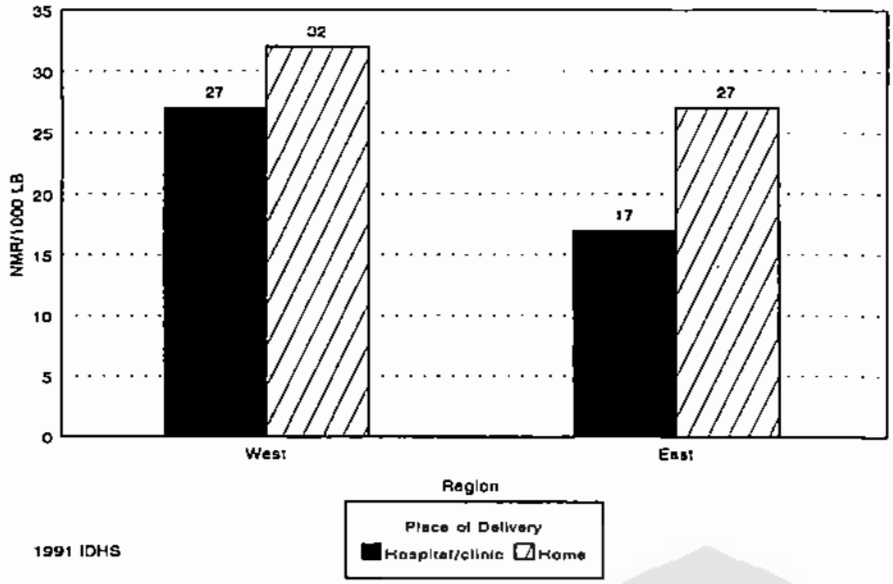
2.6 Neonatal, postneonatal and infant mortality rate by region and place of childbirth

As can be seen from Figure 1, neonatal mortality is higher in Western Indonesia than in Eastern Indonesia. This differential is held even after controlling for the place of childbirth (Figure 6). Figure 6 also shows that both in Western and Eastern Indonesia mothers who gave births at the hospital/clinic experience lower neonatal mortality than mothers who gave birth at home. It is reasonable since those who gave birth at the hospital/clinic were given knowledge how to take care of their babies and when they should take their babies to the hospital to get immunization. Although the results of bivariate analysis indicate there is association between neonatal mortality and place of childbirth, the results of multivariate analysis indicate an insignificant relationship between them.

The pattern of postneonatal mortality rate by region and place of childbirth is the same as the pattern of neonatal mortality rate. Mothers who gave birth at home have higher postneonatal mortality rate than mothers who gave births at the hospital/clinic both in Western Indonesia (four times) and in Eastern Indonesia (two times). The results of multivariate analysis indicate that place of childbirth has a very significant influence on postneonatal mortality.

In general the infant mortality rate is lower for those who gave birth at the hospital/clinic both in Western Indonesia (two times) and in Eastern Indonesia (two times). The results of multivariate analysis indicate that this relationship is not significant.

Figure 6
NEONATAL MORTALITY BY REGION AND PLACE OF DELIVERY

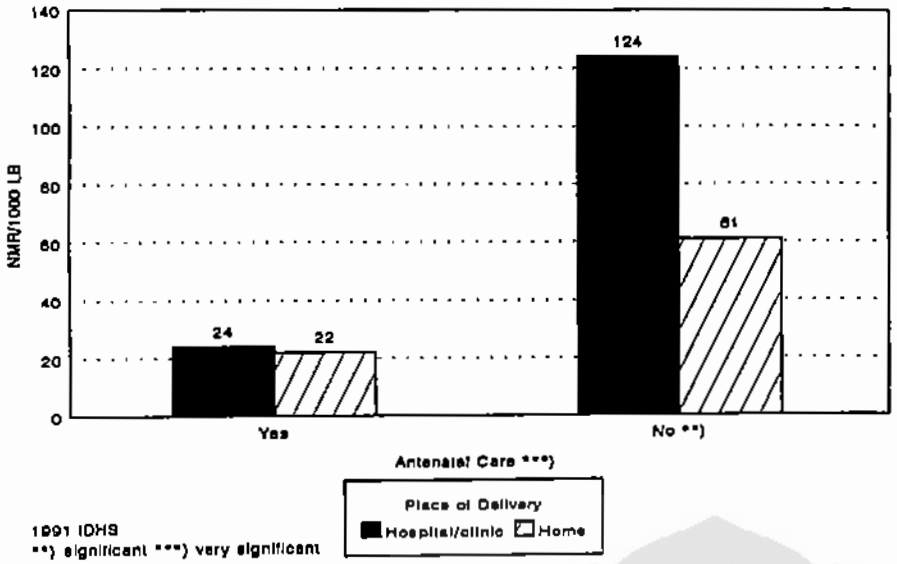


2.7 Neonatal and infant mortality rate by the presence of antenatal care and place of childbirth

Figure 7 shows that mothers who did not have their pregnancies checked up have quite a high neonatal mortality rate, both for those who gave birth at the hospital/clinic and at home. Those who did not have antenatal care and gave birth at the hospital/clinic have a neonatal mortality rate five times higher than those who had antenatal care during their pregnancies. Meanwhile, those who did not have antenatal care and gave birth at home have a neonatal mortality rate three times higher than those who had antenatal care during their pregnancies.

Another interesting discovery is that those who did not have antenatal care and gave birth at the hospital/clinic have a neonatal mortality rate two times higher than those who gave birth at home but had antenatal care. It might be because those who did not have antenatal care had complications during their pregnancies and were referred to the hospital/clinic to give birth. The results show that the presence of antenatal care has significant impact on neonatal mortality.

Figure 7
NEONATAL MORTALITY RATE BY THE PRESENCE OF ANTENATAL CARE AND PLACE OF DELIVERY



For those who had antenatal care the pattern of infant mortality rate by the place of childbirth is different from the pattern of neonatal mortality rate. It may be that infant mortality is influenced by other factors, not the place of childbirth. The effect of the place of childbirth should be shown in the first month after childbirth. The results of multivariate analysis indicate the factor which has influence on infant mortality is the presence of antenatal care.

2.8 Neonatal, infant and postneonatal mortality rate by the presence of antenatal care and delivery assistance

Another interesting result is that for mothers who had antenatal care, the neonatal mortality rate is no different between those who were helped by medical staff and who were helped by non-medical staff at childbirth (Figure 8). However, for those who had no antenatal care the neonatal mortality rate is higher for those who were helped by medical staff than for those who were helped by non-medical staff. The same pattern happened for infant mortality rate. This might have happened because mothers who had no antenatal care but

were helped by medical staff at delivery already had complications with their pregnancies.

The results of multivariate analysis indicate that the delivery assistant has no significant effect on the neonatal mortality rate but has a very significant impact on postneonatal mortality. As can be seen from Figure 8A, mothers who were helped by non-medical staff at childbirth have a postneonatal mortality rate 1.5 times higher than mothers who were helped by medical staff.

Figure 8
NEONATAL MORTALITY RATE BY THE PRESENCE OF ANTENATAL CARE AND DELIVERY ASSISTANTS

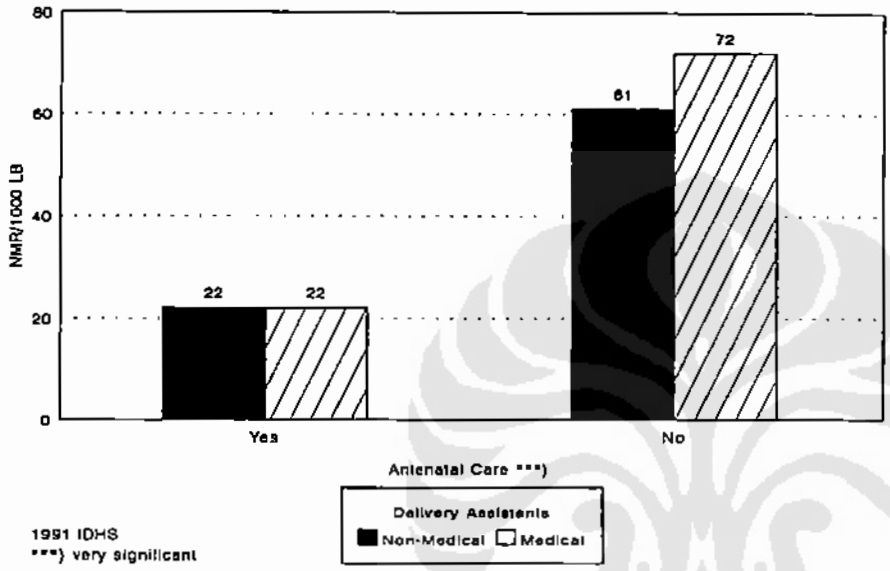
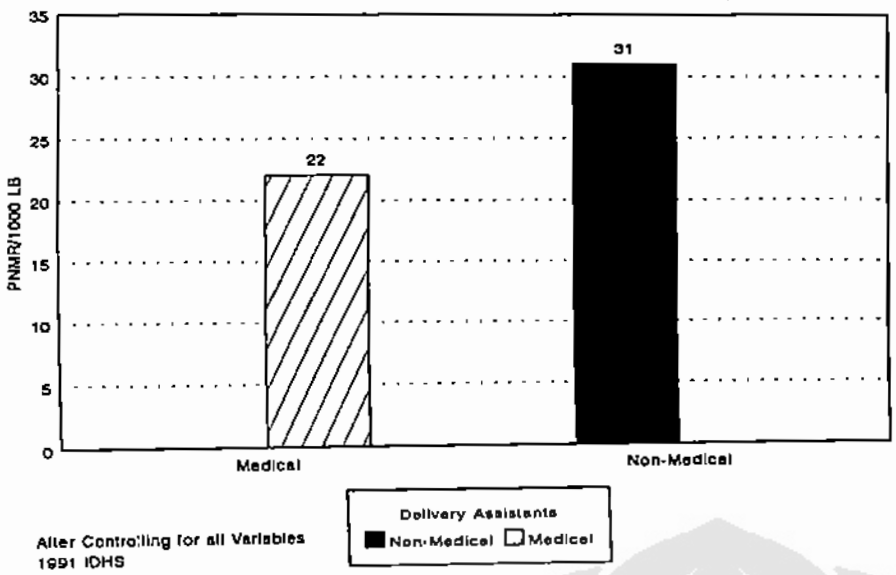


Figure 8A
POSTNEONATAL MORTALITY RATE
BY DELIVERY ASSISTANTS



2.9 Infant, neonatal and postneonatal mortality rate by mother's age at childbirth and birth interval

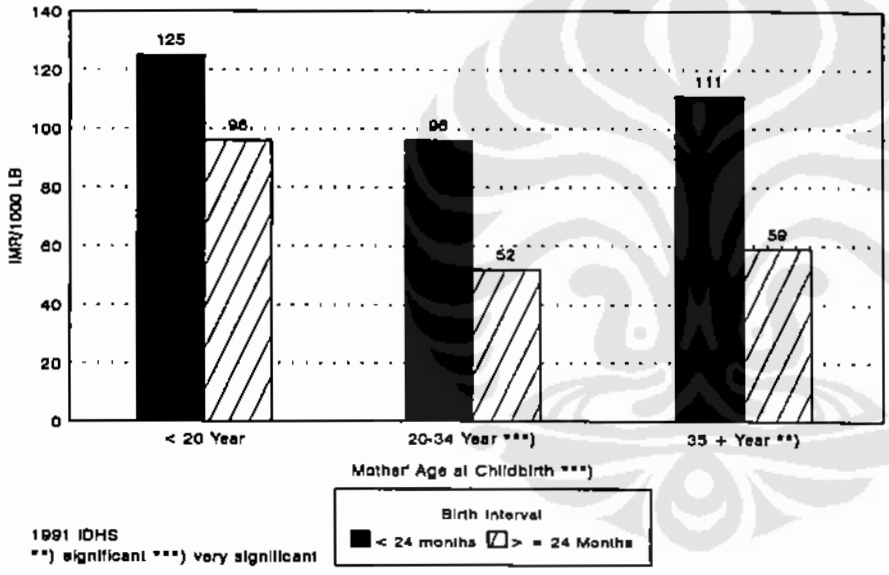
In the previous analysis it is shown that the relationship between the IMR and mother's age at childbirth follows a U-shape. The pattern remains after taking into account the birth interval (Figure 9). Figure 9 also shows that mothers who spaced their consequent births for 24 months or longer have a lower infant mortality rate than mothers who spaced their consequent birth at intervals of less than 24 months for all age groups at childbirth.

For those who gave birth at age 20 or younger the IMR is 1.3 times higher for those who had a birth interval less than 24 months than for those who had a birth interval 24 months or longer. However, this difference is not significant. For mothers who gave births at age 20-34 or at age 35 or older the IMR is almost two times higher for those who had a birth interval less than 24 months than for those who had a birth interval 24 months or longer.

In contrast, for those who gave births at age 20 or younger the neonatal mortality rate is lower for those who spaced their consecutive births for less than 24 months than for those who spaced their consecutive births for 24 months or longer. Meanwhile, for those who gave birth at age 20-34 the neonatal mortality rate is 1.5 times higher for those who spaced their births for less than two years than for those who spaced their births for two years or longer. For the same group of mothers, the IMR is significantly 1.8 times higher. For those who gave birth at age 35 or older, the neonatal mortality rate is 2.5 times higher for those who spaced their birth for less than two years than for those who spaced their births for two years or longer. For the same group of mothers, the IMR is 1.9 times higher.

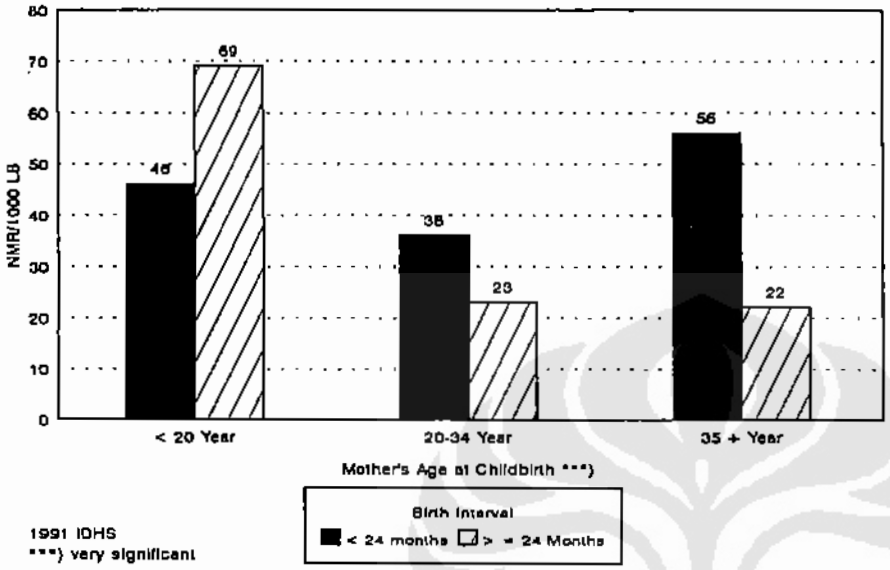
Comparing Figure 9 and 10 it can be seen that the birth interval has a stronger relationship with the IMR. With neonatal mortality, the birth interval has impact on mothers who gave births at age 20 or older.

Figure 9
INFANT MORTALITY RATE BY MOTHER'S AGE AT CHILDBIRTH AND BIRTH INTERVAL



The results of multivariate analysis indicate that the birth interval has a very significant influence on infant, neonatal and postneonatal mortality. Mothers who had a birth interval less than two years have a neonatal, postneonatal and infant mortality rate 1.3, two and 1.7 times higher respectively than mothers who had a birth interval two years or longer.

Figure 10
NEONATAL MORTALITY RATE BY MOTHER'S AGE AT CHILDBIRTH AND BIRTH INTERVAL



2.10 Postneonatal mortality rate by area and sanitation facilities

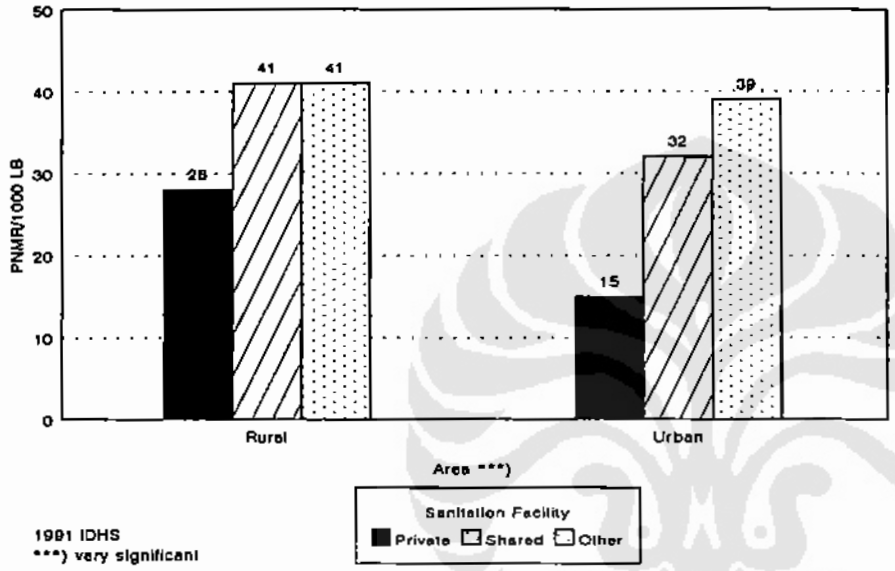
The right and healthy use of a sanitation facility is one of the indicators of the health of a family. Figure 11 shows that mothers who used a private septic tank have a lower postneonatal mortality rate than mothers who used shared public septic tanks or other sanitation facilities. This is held both in urban and rural areas.

By area of residence, the postneonatal mortality rate is lower in urban areas than in rural areas for those who used private septic tanks or shared public septic tanks. Mothers in urban areas who used shared public septic tanks or other

facilities have postneonatal mortality rate two times higher than those who used private septic tanks. For the same group of mothers in rural areas the rate is 1.5 times higher. The urban-rural difference might be due to the higher knowledge and better socioeconomic and environmental conditions of mothers who lived in urban areas which results in better knowledge on health.

The results of multivariate analysis indicate that the use of sanitation facilities has a very significant impact on postneonatal mortality. Families who used private septic tanks have a lower postneonatal mortality than families who used shared public septic tanks or other facilities.

Figure 11
POSTNEONATAL MORTALITY RATE BY AREA AND SANITATION FACILITY



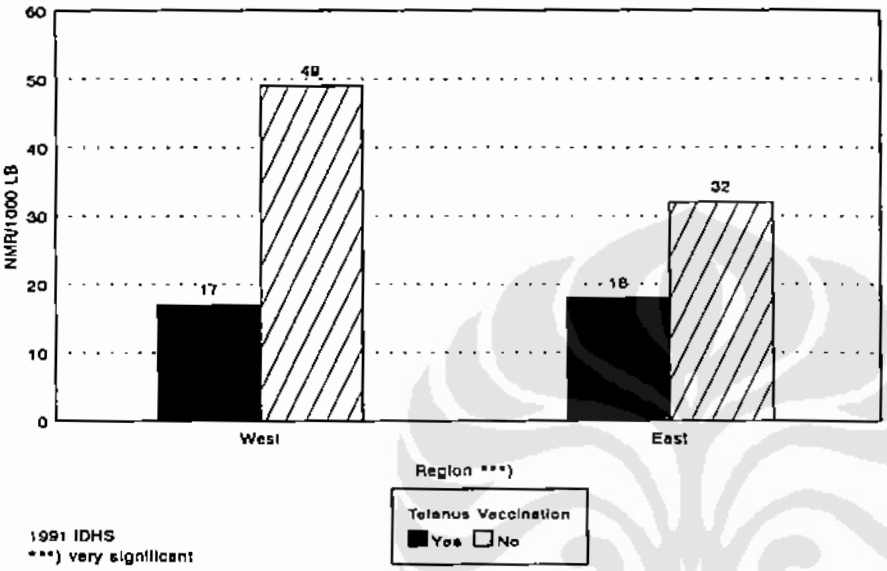
2.11 Neonatal, postneonatal and infant mortality rate by region and tetanus vaccination

Vaccination is one of the factors which can influence a child's health. Children who are vaccinated are expected to have good health. The results indicate that 56.4 percent of pregnant mothers had received a tetanus vaccination during their pregnancies. By region, the figure is 58.1 percent for Western Indonesia and 45.9 percent for Eastern Indonesia.

Figure 12 shows that mothers who received tetanus immunizations during their pregnancies have a far lower neonatal mortality rate than mothers who did not receive tetanus immunizations both in Western and Eastern Indonesia.

In Western Indonesia the neonatal mortality rate (NMR) for mothers who had tetanus vaccination is one third of the NMR for mothers who did not have tetanus vaccination during their pregnancies. In Eastern Indonesia the NMR for mothers who had a tetanus vaccination is one half of the PNMR for mothers who did not have a tetanus vaccination during their pregnancies.

Figure 12
NEONATAL MORTALITY RATE BY REGION AND TETANUS VACCINATION



The results of multivariate analysis support that the presence of tetanus vaccination during pregnancy has an impact on neonatal mortality. Mothers who did not have a tetanus vaccination during pregnancy have a neonatal mortality rate two times higher than mothers who had a tetanus vaccination during their pregnancies. The results is the same for postneonatal and infant mortality.

3. Policy Implication

Among all factors analyzed it is found that the presence of antenatal care and tetanus vaccination during pregnancy have the strongest impact on infant mortality, in particular during the neonatal period. The presence of these

two factors reduces infant mortality rate to a significant extent. This indicates that the government should improve and enhance the Mother and Child Health (MCH) program which emphasizes antenatal care and tetanus vaccination during pregnancy.

Eight-twelve percent of mothers in Western Indonesia did not have antenatal care. They might be mothers who were at high risk so we need to know why they did not have their pregnancies checked up. In Eastern Indonesia the figure is quite high (40 percent). Therefore the effort to extend the service coverage for antenatal care is still needed.

To lower the infant mortality rate for high risk mothers (those who first married below the age of 18, who give birth at an age younger than 20 and those who have low education) the special programs are needed to handle them, for example, by improving EIC program about the safe ages to give birth.

Birth spacing is another important factor which lower infant mortality. As breastfeeding is associated with birth interval then it is necessary to promote the use of contraceptive methods which do not interrupt the production of breastmilk. As the postneonatal mortality rate is high for mothers who have a short birth interval, so it is necessary to inform them intensively how to take care of their children properly.

Kasmiyati, Dra., MSc. Researcher and Chief of Division, Utilization and Evaluation of Population and Family Planning Research Center, National Family Planning Coordinating Board (NFPCB). Phone: (62-21) 8002406.

Leli Asih, Dra. Researcher at the Biomedical and Human Reproduction Research Center, NFPCB.

Emiliana Tjitra, Dra. Researcher at the Departement of Health, Republic of Indonesia.

Handriah Oesman, Dra., MS. Researcher and Chief of Sub-Division Evaluation and Reporting, Biomedical and Human Reproduction Research Center, NFPCB.